METAMODEL FOR SERVICE DESIGN AND SERVICE INNOVATION: INTEGRATING SERVICE ACTIVITIES, SERVICE SYSTEMS, AND VALUE CONSTELLATIONS

Completed Research Paper

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Abstract

This paper presents a metamodel that addresses service system design and innovation by traversing and integrating three essential layers, service activities, service systems, and value constellations. The metamodel's approach to service systems as service-in-operation is an alternative to another currently used approach that views service systems as systems of economic exchange. The metamodel addresses service science topics including basic concepts of service science, design thinking for service systems, decomposition within service systems, and integration of IT service architecture with customer services.

This paper's contributions to service science include clarifications concerning concepts such as service, service system, customer, product/service, coproduction and cocreation of value, actor roles, resources, symmetrical treatment of automated and non-automated service systems, and the relationship between service-dominant logic and service systems. Many articles have discussed these topics individually. Few, if any, have tied them together using an integrated metamodel.

Keywords: service system, service design, service innovation

Need for Usable, Design-Oriented Models

Building upon previous developments in services marketing, service operations, and economics, the recent initiative to develop academic programs in SSME (service science, management, and engineering) and a science of service has received wide attention and has generated a number of service-related academic programs and a flurry of interesting articles, white papers, and most recently, books (e.g., Chesborough and Spohrer 2006; Spohrer et al. 2007; IfM and IBM 2008; Spohrer et al. 2008; Maglio and Spohrer 2008; Vargo and Akaka 2009; Maglio et al. 2010; Demirkan et al. 2011). Although efforts to study and teach about services started decades ago, the concerted effort to develop a new discipline called service science probably was launched around 2003 or 2004 (based on Kucharvy 2010; Zhao et al. 2004).

At this early stage in the development of service science, leading proponents seem to have settled on a view of the nature of service and service systems in which the essence of service systems concerns economic exchange, as will be explained later. That model deals with many fundamental topics, but its focus and level of analysis are somewhat removed from everyday operational issues related to service system design and service system innovation. This paper presents a metamodel of service-in-operation that more directly addresses issues that must be resolved in service system design and innovation in real world situations. The metamodel is only partially consistent with the economic exchange model because it focuses on service systems in operation, is on a different level of analysis, and uses some terms differently. (A metamodel is a summary of relationships between concepts for producing conceptual models of specific situations in a domain. For example, the fact that the concepts "informational entity" and "actor role" are part of this paper's metamodel for service system design implies that a conceptual model of a specific service system in a specific organization should identify informational entities and actor roles for that specific system.)

This paper addresses a number of the items in a bullet list of topics in the call for papers for the Service Science track of ICIS 2011. It proposes an alternative view of basic *service science concepts* that differs from other current views. It presents an integrated metamodel that can be used to support *design thinking for service systems*, to support *decomposition within service systems*, and to represent *service systems and service networks*. It can be used in relation to the *integration of IT service architecture* with *customer services*. It may provide some insights concerning the challenges of *automated service composition* and *business process synthesis*. (The italicized terms are from the bullet list of suggested topics in the call for papers.)

Contribution. This paper contributes to service science by providing a comprehensive metamodel that supports service system design through its structure and definition of terms, and by providing an alternative view of service systems. First, it provides an integrated metamodel of service-in-operation that covers service activities, service systems, and value constellations, thereby extending an earlier metamodel (Alter 2010a) that was developed to provide an integrated view of social and technical aspects of work systems. A number of features of the new metamodel represent progress for service science. By spanning three levels of analysis, the metamodel articulates a cohesive view of topics that are usually discussed separately, and often in a highly abstract way that is useful for theoretical explorations but difficult to operationalize when designing service systems. The metamodel incorporates coproduction of service in an operational way rather than just treating coproduction as a defining characteristic of service in general. Its integrated view of sociotechnical service systems and completely automated service systems supports decomposition of sociotechnical systems into smaller sociotechnical subsystems and totally automated subsystems, an essential issue in designing IT-enabled service systems. Overall, the metamodel's integrated view of value constellations, service systems, and service activities is sufficiently detailed that it could facilitate service design and service innovation processes. Due to its specificity and incorporation of clarifications related to basic terms, it could contribute more directly to service system design than some of the theoretical literature's distinctions related to the nature of service, service systems, economic exchange, and value propositions. The metamodel's additional contribution to service science is its articulation of an alternative view of service systems that is substantially different from the view that is currently favored by many authors. The metamodel treats service systems as operational systems rather than as theoretical systems of economic exchange.

Organization. This paper is organized as follows. First is a literature review covering alternative definitions of service and service system and other relevant topics such as service-dominant logic, coproduction of value, value configurations, and value constellations. Next is a summary of definitions and premises underlying the new metamodel for service system design. The presentation of the metamodel emphasizes topics related to service science. The discussion and conclusion sections explain more about the nature of this paper's contribution and the potential usefulness of the metamodel.

Literature Review

This literature review emphasizes topics that help in positioning this paper's metamodel of service-in-operation in relation to the service science literature.

Service. Ideally a definition of service should cover any situation that qualifies as a service, should not introduce unnecessary restrictions on what a service is, and should emphasize only the essence of the topic. Below are eight definitions of service. To test the definitions, each is followed by a comment about whether the definition captures the essence of the Netflix CD rental service, which uses a web site to allow customers to list the CDs they would like to borrow and mails CDs to the customers in accordance with the customer's contract for the number of CDs that can be borrowed during a period. (We ignore recent Netflix initiatives related to online access.)

1. "Any act or performance that one party can offer to another that is essentially intangible and does not result in the ownership of anything." (Kotler and Keller 2006). In contrast, Netflix gives their customers temporary custody of tangible physical objects.
2. "A provider-client interaction that creates and captures value" (IBM Research 2009). In contrast, some of the value is in the interaction and some of the value is in the customer's ability to enjoy CDs.
3. "A simultaneous or near-simultaneous exchange of production and consumption, transformation in the experience and value that customers receive from engagement with providers, and intangibility in that goods are not exchanged." (Rai and Sambamurthy 2006). In contrast, use of the CD (analogous to consumption) is not simultaneous with production, involves exchange of custody of goods, and might take place over weeks.
4. "A time-perishable, intangible experience performed for a customer acting in the role of a coproducer" (Fitzsimmons and Fitzsimmons 2006). In contrast, being a customer of Netflix does not seem like a time-perishable, intangible experience.
5. A process in which "the customer provides significant inputs into the production process." (Sampson and Froehle 2006). Consistent with this definition, the customer provides inputs into the production process by selecting CDs. The customer is uninvolved with internal processes at Netflix.
6. "A change in the condition of a person, or a good belonging to some economic entity, brought about as a result of some other economic entity, with the approval of the first person or economic entity" (Hill 1977). In relation to this definition, Netflix changes the condition of a customer from not having custody of a CD to having it available to use, although saying it that way does not seem very natural.
7. "Capabilities or competencies that one person, organization, enterprise, or system provides for another" (Vargo and Lusch 2004a). Netflix provides capabilities for its customers, although from a customer viewpoint what customers really want is the CDs, not capabilities or competencies.
8. A service "is generally implemented as a course-grained, discoverable software entity that exists as a single instance and interacts with applications and other services through a loosely coupled (often asynchronous), message-based communication model." (Brown et al. 2005). It is clear that services provided by Netflix are not "course-grained discoverable software entities" even though parts of Netflix's internal computing capabilities may well use services that can be defined that way.

While it is easy to argue with any of the comments about whether the definitions capture the essence of what Netflix does, the main conclusion is that it is difficult to find a satisfying definition of service. Our metamodel will use a dictionary-like definition that is consistent with #7, but much simpler in intention.

Service system. Although service science is being promoted as a science of service systems, a Google search on "definition of service system" finds surprisingly few clear definitions. The definition of service system in the glossary of the CMMI (Capability Maturity Model Integration) for Services, version 1.3 is "an integrated and interdependent combination of component resources that satisfies service requirements. A service system encompasses *everything* required for service delivery, including work

products, processes, facilities, tools, consumables, and human resources. Note that a service system includes the people necessary to perform the service system's processes. " (Software Engineering Institute 2010). Another relatively simple definition that includes both sociotechnical and totally automated service systems is a work system that produces services for its customers, where a "work system is a system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers." (Alter 2008c, 2010d). An alternative definition that permits only sociotechnical service systems is "a voluntary and human usable system, that is, a usable system which contains a significant level of people or organizations as components during use; and needs the voluntary engagement of an external person/organization to produce value." (Pinhanez 2009)

The currently favored definition of service system in the service science community is more complex:

- "A service system represents any value-cocreation configuration of people, technology, value propositions connecting internal and external service systems, and shared information (e.g., language, laws, and measures). The smallest service system centers on an individual as he or she interacts with others, and the largest service system comprises the global economy. Cities, city departments, businesses, business departments, nations, and national agencies are all service systems." (Maglio and Spohrer 2008, cited by Vargo and Lusch 2008).
- A related White Paper (IfM and IBM 2008) based on a symposium of leading researchers in Cambridge, UK says that "service systems are complex adaptive systems" and distinguishes between a customer service system and a provider service system. A customer service system "is a service system from the viewpoint of a customer or consumer. A customer service system searches provider value propositions looking for win-win value-cocreation opportunities." A provider service system is "a service system from the viewpoint of a provider. A provider service system aims to meet the customer's needs better than competing alternatives consistently and profitably (in business context) or sustainably (in non-business context). Provider service systems seek deep knowledge of customer service systems ... to improve existing, and create new, value propositions."
- Another paper extends the focus on economic exchange, saying that "the study of service systems emphasizes collaboration and adaptation in value cocreation, and establishes a balanced and interdependent framework for systems of reciprocal service provision. These systems can be individuals or groups of individuals (e.g., families, firms, nations, etc.) that survive, adapt, and evolve through exchange and application of resources – particularly knowledge and skills – with other systems. Simply put, service systems engage in exchange with other service systems to enhance adaptability and survivability – thus, cocreating value – for themselves and others." (Vargo et al. 2008)

As is explained in Alter (2011), the approach to service systems in those three excerpts is quite abstract, focuses on economic exchange rather than business operations, and treats anything from an individual to the global economy as a service system. Concepts such as cocreation of value, value proposition, shared information, and reciprocal service provision sometimes seem overstated for service systems such as medical care, which is characterized by conflicting motives, ambiguous or intentionally misleading value propositions (e.g., advertising), and information asymmetry, and where the beneficiaries of care often are not the paying customers and therefore may have few decision rights related to choosing among value propositions. This paper's metamodel is based on the definition of service system from Alter (2010d), which is easier to operationalize and apply across a wide range of service situations.

Service-dominant logic is often cited as fundamental to service science. Arguing that traditional goods-dominant logic has inherent shortcomings in relation to understanding economic exchange, Vargo and Lusch (2004a) introduced the idea of service-dominant logic, whose original eight foundational premises (later expanded to 10) start with FP1, "the application of specialized skill(s) and knowledge is the fundamental unit of exchange," and FP2, "indirect exchange masks the fundamental unit of exchange," and include other premises such as FP4, "knowledge is the fundamental source of competitive advantage" and "FP5, all economies are service economies." Those premises are not directly related to this paper's metamodel, which focuses on the design of service systems in operation, rather than the nature of economic exchange, the basis of competition, or the nature of the economies. Several other foundational premises are more relevant. "FP3, goods are a distribution mechanism for service provision" basically says that products are services packaged in a different form. The definition of service used in the metamodel is consistent with that premise. FP6, "the customer is always a coproducer," is reflected in the metamodel to

some extent because services are triggered (and hence coproduced to at least a minimal extent) by a request from someone who will receive some kind of benefit as a result. Also, the metamodel designates human actors who perform activities within service systems as either customer participants or non-customer participants. The relationship between the foundational premises of service-dominant logic and the approach to service systems taken in this paper is explained further in Alter (2010b).

Value and coproduction of value. The term value has received a great deal of attention in marketing, service, and other fields. Vargo et al. (2008) note that Aristotle differentiated between value-in-use and value-in-exchange over 2000 years ago. Ramirez (1998) traces the historical development of that distinction, including that "the proposition that utility is subjectively assessed arose in the 18th century; the idea that personal judgment establishes the value of things flourished in the 19th century." After tracing the history of the concept of value coproduction for 290 years across many authors, Ramirez (1998) notes that Normann and Ramirez (1993, 1994) "extended the notion of services to cover all activities in which obtaining actual utility value requires customer value creation" and that they used the term offerings to refer to the link between actions by supplier and customer. "The value of offerings is established only partially in terms of the activity which the supplier has poured into these" [offerings]. Value to the customer includes labor saving value, whereby customers do not have to carry out the activities 'crystallized' in the acquisition," and enabling value, which is related to "the enhanced ease, productivity, safety, elegance, and/or effectiveness" in the acquirer's value creating actions. This paper's metamodel recognizes coproduction of services by saying that actor roles in performing a service activity may be played by customer participants, non-customer participants, and/or automated agents. It deals with value assessments and other subjective issues only as types of attributes of entities types.

Value configurations and value constellations. Porter (1985) introduced the idea of value chain analysis in relation to how a particular firm operates through primary (value-adding) activities and support activities. Normann and Ramírez (1994) extended that idea with the concept of *value constellation*, where "value is coproduced by actors who interface with each other. They allocate the tasks involved in value creation among themselves and to others, in time and space, explicitly or implicitly." Others have extended that idea further with strategy-oriented discussions of value configurations (Stabell and Fjelstad), networked value constellations (Tapscott et al. 2000) and various business modeling techniques mentioned by Pijpers and Gordjin (2007a) in papers such as a business model ontology (Osterwalder et al. 2005), REA (Geerts and McCarthy 1999), e3 value (Gordijn and Akkermans 2001), and e3 forces (Pipjers and Gordjin 2007b). Vargo et al. (2008) note that Spohrer et al. (2007; 2008) see "service science as the study of service systems and of the cocreation of value within complex constellations of integrated resources." Our metamodel is primarily concerned with operational service design rather than business model or strategy generation even though it includes strategy at several levels.

Modeling of businesses and service systems. The literature contains many methods related to the modeling of enterprise architecture, processes, and service systems. An IBM Technical Report (Glissmann and Sanz 2009) summarizes and compares ten approaches to enterprise architecture including ArchiMate (from the Open Group), the IT architecture ecosystem (from the Object Management Group), Business Process Modeling Notation (BPMN, from the Object Management Group), component business modeling (from IBM), event-driven process chain (from ARIS), and others. Osterwald and Pigneur (2009) identify the nine building blocks of a business model. Sociotechnical approaches to describing and analyzing systems in organizations include Mumford's ETHICS methodology (Mumford and Weir,1979; Hirschheim and Klein,1994), Multiview (Avison and Wood-Harper, 1990), activity theory (Kuutti 1995), and the work system method (Alter 2006). UML, BPMN, and other modeling formalisms apply to any tightly structured business process. UML activity diagrams are an especially useful tool for looking at service systems because they represent the sequence of activities and use swim lanes to identify which role or department performs each activity. Service blueprinting (Bitner et al. 2008) is an extended version of an activity diagram that traces five components across a service process: customer actions, onstage contact employee actions, backstage contact employee actions, support processes, and physical evidence.

Definitions and Premises in the Metamodel for Service System Design

Next we define service and explain some of the metamodel's underlying premises.

Definition of Service

We adopt a simple, dictionary-like definition of service from Alter 2008b. "Services are acts performed for others, including the provision of resources that others will use." To provide a symmetrical way of treating human and automated services for people and services performed by one automated entity for another (such as web services), a more general version of the definition of service replaces the word "others" with "other entities," whereby services are acts performed for other entities including the provision of resources that other entities will use.

Both versions of the definition are consistent with the idea in Ramirez (1998) that customer value includes labor saving value and enabling value. It applies to the three types of value configurations discussed by Stabell and Fjeldstad (1998), value chains, value networks, and value shops. It covers special cases such as self-service and automated services for people. In self-service, service providers provide resources that are used by customers performing self-service activities. In that case, the service is the provision of resources, not the self-service activities. In automated services for people, machines perform the service activities. Both versions of the definition are consistent with most of the definition in Vargo and Lusch (2004a), that services are "the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself." A point of disagreement is that our definition stipulates that services are acts performed for others. Thus, activities performed only for one's own benefit, such as cleaning one's own office or climbing a mountain, are not considered services unless those acts are performed in order that someone else will benefit.

By assuming that every purposeful action performed for the benefit of others is a service, our definition bypasses the longstanding inability to distinguish between products and services in a way that is genuinely valuable for designing service systems. Instead, the definition accepts the foundational premise from service-dominant logic that "goods are distribution mechanisms for service provision" (Vargo and Lusch 2004a), according to which distinctions between products and services may not be fundamental for understanding how value is delivered. If a service is an act performed for others, then the production of physical things can be viewed as services. To reflect the definition, the metamodel for service design contains the entity type "product/service," which is treated as an output of a service activity.

With our definition of service, any economic activity is a service because it involves purposeful action performed for the benefit of someone else (or something else, in the case of programs operating under service computing). Focus on services is still useful, however, because it encourages the use of service metaphors when thinking about almost any system in a business. Of special value are the numerous service-related design dimensions that are potentially important but often overlooked when trying to design or evaluate systems in organizations, such as the extent of customer responsibility for service activities, the extent of coproduction, and the extent to which activities are front stage or back stage.

Several other implications of the definition are noteworthy. First, the immediate object of services may not perceive their value. For example, a baby may not perceive the value of babysitting; a student may not perceive the value of a classroom exercise; an addicted individual may not perceive the value of a treatment; a taxpayer may not perceive the value of tax-related services by tax agencies. These examples illustrate that most service systems have multiple customers. An additional point is that services may or may not be legal. If only legal acts were services, then something that is a service today might not be a service tomorrow or might be a service in one place but not in another, even if performed identically. Thus, selling alcohol to a teenager is a service even though it may be illegal in some locations and even though it may be contrary to moral or ethical beliefs. If services had to be legal, determining whether something is or is not a service might require a lawyer.

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Other Definitions and Premises

The metamodel is built on the above definition of service and on other definitions and premises:

Definition of service system as a work system. As a category, a service system is a work system that produces services. A work system is a system in which human participants and/or machines perform work using information, technology, and other resources to produce products and/or services for internal or external customers. (Alter 2006; 2008a). All work systems involved in economic exchange are service systems because they perform work to produce something for the benefit of others. A very small percentage of work systems are not service systems because they involve someone performing work only for personal benefit, such as cleaning one's own office or making one's own lunch. Given the limited practical value of that distinction, the rest of the this paper will assume that all work systems are service systems, and, by definition, that all service systems are work systems.

Definition of value constellation. A value constellation is a set of complementary service systems whose individual operation and interactions produce an identifiable type of service for an identifiable group of customers. A given service system may be part of many different value constellations.

Value creation and cocreation of value. All service systems produce something of value for at least some of their customers. Service systems that produce nothing of value to any customer should not exist, and should be terminated by competent management.

Scope of the metamodel. The metamodel covers all operational systems that provide service. Based on the definition of service, this covers:

- services for external customers and for internal customers,
- automated, IT-reliant, and non-automated services,
- customized, semi-customized, and non-customized services,
- personal and impersonal services,
- repetitive and non-repetitive services,
- long-term and short-term services,
- services with varying degrees of self-service responsibilities.

In contrast, many discussions of service science seem to be directed toward enormously complex service system in the societal realm. The metamodel is much better suited for smaller, more understandable systems at the scale encountered directly by most business professionals.

Service industries and service economies. The metamodel is concerned with operational service systems that may be directed externally by serving an enterprise's customers or may be directed internally by serving employees or internal departments. With that orientation, the metamodel is not concerned with distinguishing between service industries and other industries, and is not concerned with characterizing the emerging service economy. It reflects its emphasis by assuming that all economic activities are services, and therefore bypassing issues about defining service industries and service economy.

Customers. Customers are recipients of a service system's products and services for purposes other than performing provider activities within the service system. External customers are service system customers who are the enterprise's customers, whereas internal customers are work system customers who are employed by the firm, such as customers of the enterprise's service system for payroll. Customers of a service system may be active participants in the service system (e.g., patients in a medical exam, students in an educational setting, and clients in a consulting engagement). In other situations, customers request service activities and play no other role in a service system. Viewing customers only as recipients of products and/or services assumes that "paying customers" who do not participate in a work system are not customers of the work system, e.g., the parent who pays for a child's tennis lessons or the firm that pays for an employee's off-site training course. The metamodel treats non-participating paying customers as important stakeholders whose interests should be considered by any service system designer. Those stakeholders are part of the service system's environment, rather than part of the service system itself.

The image of "the customer" is largely an illusion for many important service systems that have different customer types whose interests are different and possibly divergent, such as a medical service system that serves patients, but it also serves insurance companies and provides information for insurance

companies, government agencies, and other external customers. Almost all internally directed service systems (such as payroll systems, planning systems, and IT service desk systems) have customers who are direct beneficiaries of the service plus an additional corporate customer that pays for the services. The distinction between direct beneficiary and paying customer is important for many decisions that occur in medical service systems and other service systems that are controlled to some extent by governmental agencies or other paying customers who are not service beneficiaries. Finally, for some customers in some situations, being a customer is neither totally voluntary nor "win-win" (see previously mentioned IfM and IBM (2008) definition of customer service system). For example, Hough (2004) noted the "greater predominance of the involuntary customer who enters the service relationship unwillingly … or involuntarily (e.g., in contact with government agencies or services)" (quoted by Rodin 2009).

Products and services. Service systems exist to produce products and/or services for internal or external customers. As noted earlier along with the definition of service, the metamodel contains the entity type "product/service," which is treated as the output of a service activity. Some product/services are inputs to other activities within a service system. Others product/services are received and used by customers either within the service system or in other service systems.

Processes and activities. The actions that occur within a service system are service activities. In some service systems those activities constitute a process because they have a clear sequence and individual steps that are performed using defined methods. Other service systems include a number of recognizable activities that may be performed in different ways and in different orders depending on the judgment of the participants. (e.g., Hall and Johnson 2009; Hill et al. 2006). Activities within a service system are assumed to be the activities that actually occur, rather than the activities that are supposed to occur. These activities include workarounds that often become part of organizational routines (Feldman and Pentland 2003) when prescribed activities are too cumbersome to perform or cannot be performed due to inadequate resources or transient problems. (For a range of views on workarounds, see Gasser 1986; Mohr and Arora 2004; itSMF 2007; Gasparas and Monteiro 2009; Safadi and Faraj 2010)

Participants. Participants are people who perform service activities within a service system, including both users and non-users of IT. Failure to include participants and their characteristics in the design of a service system automatically would omit important sources of variation in the results. Inclusion of the term *participant* instead of the term *user* avoids ignoring important participants who do not use computers and minimizes confusion from referring to stakeholders as users, whether or not they actually use the technology in a service system. Customers participate in service systems to differing extents.

Information. All service systems use or create information, which in the context of service systems can be expressed as informational entities that are used, created, captured, transmitted, stored, retrieved, manipulated, updated, displayed, and/or deleted by processes and activities. Typical informational entities include orders, invoices, warranties, schedules, income statements, reservations, medical histories, resumes, job descriptions, and job offers. Informational entities may contain other informational entities. For example, orders may contain line items and documents may contain chapters.

Technologies. Almost all significant service systems rely on technology, which includes both tools that are used by work system participants and automated agents, hardware/software configurations that perform totally automated activities. That distinction is crucial as service systems are decomposed into successively smaller subsystems, some of which are totally automated.

Environment. Factors in a service system's environment may have direct or indirect impacts on its performance, aspiration levels, goals, and requirements for change. A service system's environment includes the relevant organizational, cultural, competitive, technical, regulatory, and demographic environment within which the service system operates, and that affects the system's effectiveness and efficiency. Organizational aspects of the environment include stakeholders, policies and procedures, and organizational history and politics, all of which are relevant to the design of many service systems.

Infrastructure. Infrastructure includes relevant human, informational, and technical resources that are used by the service system but are managed outside of it and are shared with other service systems. Infrastructure can be subdivided into human infrastructure, informational infrastructure, and technical infrastructure, and all of which can be essential to a service system's operation.

Strategies. Strategies that are relevant to a service system include enterprise strategy, organization strategy, and service system strategy. In general, strategies at the three levels should be in alignment, and service system strategies should support organization and enterprise strategies. Unfortunately, strategies at any of the three levels may not be articulated or may be inconsistent with reality or with beliefs and understandings of important stakeholders.

Integrated view of automated and non-automated services. The issue of symmetry or asymmetry in the treatment of automated and non-automated activities has been discussed many times in the IS field in debates about actor-network theory and human versus material agency. (e.g., Orlikowski 2005; Rose et al. 2005; Leonardi 2011). For purposes of the metamodel, automated and non-automated services should be treated as consistently and symmetrically as possible while also recognizing that human agency is different from machine agency in many important ways involving abilities to perceive, judge, and act, especially in regard to incentives, ethics, values, and knowledge.

Characteristics and attributes of service systems. Consistent with Vargo and Lusch (2004b), our definition of service does not rely on service characteristics such as intangibility, customization, simultaneity of production and consumption, time-perishability, or involvement of customer interactions or experiences. The metamodel treats such characteristics as continuous design variables that apply to different services in differing degrees and can be set to different levels depending on the goals of the service situation. Similarly, while coproduction of value appears in some definitions of service, coproduction can also be viewed as a continuous design variable that ranges from a customer making a request for a service (a minimal level of coproduction), through customer participation in some aspects of service fulfillment processes (beyond specifying requirements), and service occurring largely through direct participation by customers in service interactions (a high degree of coproduction). Viewing coproduction as a continuous variable rather than a yes/no question shifts focus to more practical and important issues concerning where and how services are produced and value accrues to customers.

Impacts of other service systems. Research related to interactions between tasks or systems has studied topics such as task interdependency (Thompson 1967), coordination theory (Malone et al., 1999; Crowston et al. 2006), and loose coupling theory (Orton and Weick 1990). The most obvious interactions between service systems are related to inputs and outputs, i.e., receipt and consumption of resources provided by other service systems and the production of products/services for use by other customers associated with other work systems. The metamodel includes an entity type called "other service system" and other types of interactions (labeled as “interactions other than input/output”) because such interactions may be important in designing service systems. Such interactions include sharing of human participants and other resources, various forms of interference that occur accidentally, and requirements that one work system may impose on another, either implicitly or explicitly (Alter, 2010a, 2010c).

Metamodel for Service Design and Service Innovation

The metamodel in Figure 1 is a revision and extension of a metamodel (Alter 2010a) that was developed to provide a framework for analysis more detailed than is afforded by the work system framework (Alter 2006, 2008a, 2008b), which is effective as the basis for summarizing and performing a preliminary analysis of an IT-reliant work system, but is less effective as a tool for deeper analysis. One of the goals of that metamodel was to provide clarifications concerned topics such as why goals were not mentioned explicitly in the work system framework, how customers can also be participants, the relationship between participants and users, and the possibility of treating a totally automated work system in a manner that is largely symmetrical to the treatment of a sociotechnical work system. As a framework for deeper analysis, that metamodel attempted to provide greater clarity about concepts and more specific guidance about relationships that are often important. Each element of the work system framework is represented in the metamodel, although most are re-interpreted in a more detailed way. For example, information becomes informational entity, technology is divided into tools and automated agents, and activities are performed by one of three types of actors. Figure 1 uses shading to distinguish between re-interpretations of elements in the work system framework and other concepts that are not in the work system framework. In the rest of this paper, the term metamodel refers to the revised version in Figure 1.

Entity types in the metamodel. Representation decisions in the metamodel attempt to maximize understandability while revealing potential omissions from a service system design process. The

metamodel uses an icon for "composition" (see legend at the bottom of Figure 1) to identify elements that are likely to be decomposed into smaller elements in some analysis and design situations. It names relationships and uses the pointed end of "<" and ">" to indicate the direction in which relationships apply. It also identifies multiplicities (e.g., (0... *) means from zero to many; (1...*) means at least one).

Each of the entity types in the metamodel has a series of attributes that are not shown in the metamodel but that might be shown in a second level in a more detailed representation (e.g., as attributes of a class in a UML class diagram). The number of potentially relevant attributes is very large. For example, many entity types in the metamodel have multiple goals, characteristics, metrics, and relevant principles that are not shown in Figure 1 but could be included in a computerized representation. For example, attributes of a participant include knowledge of various types, skills of various types, level of motivation, incentives, among many others. Attributes of an informational entity depend on the type of informational entity (e.g., database or document) and include attributes related to size, form, coding scheme (if any), precision, and accuracy. Most entity types have at least several typical goal attributes that may be mutually inconsistent in any specific situation. For example, the role non-customer participant may have a daily output goal but may also have other goals related to error rate, responsiveness to the service system's customers, or other aspects of quality.

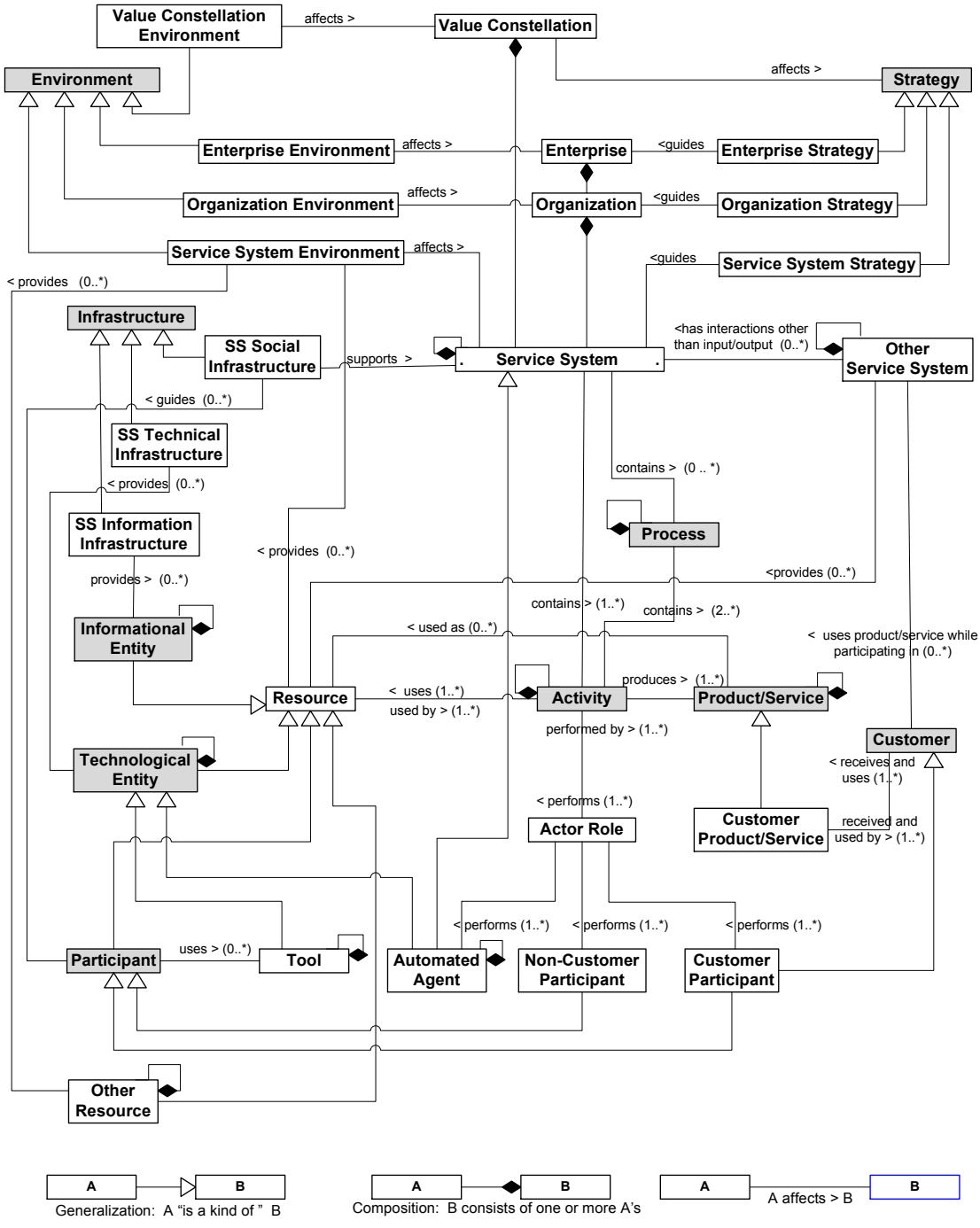
Integrating service activities, service systems, and value constellations. The metamodel for service system design in Figure 1 covers service system design at three levels:

- service activities: methods and other details of specific service activities within service systems
- service systems as a whole, and their immediate relationships to and interactions with their customers and other systems that affect them
- value constellations: recognizing the role of a service system within broader value constellations.

The revision of the previous metamodel in Alter (201a) that produced Figure 1 started with terminology changes, such as replacing the term work system and its abbreviation WS with the term service system and its abbreviation SS. Value constellation and value constellation environment were inserted at the top center of the metamodel. The metamodel says that a value constellation consists of one or more service systems, that a value constellation's environment affects the value constellation, that a value constellation's environment is part of the environment that might be considered when designing a service system, and that the value constellation might affect strategy at any of three levels: enterprise strategy, organization strategy, and service system strategy. A value constellation is assumed not to have a strategy because it consists of many semi-independent service systems that are not centrally controlled and that will change and evolve based on their own priorities.

Resources, structure, and intention. The metamodel is organized to emphasize the interplay of resources, structure, and intentions. In general, the metamodel is laid out with resources on the left side, structural and operational elements in the middle, and elements related to intention on the right. The central elements in the metamodel are the service system itself (upper middle), activities that it performs (lower middle), and relevant value constellations (top center).

Resources for a service system include participants, technological entities, informational entities, and other resources used by activities. Non-human resources might be produced by previous activities within the service system, or might come from other service systems, from the environment, or from any of three components of the infrastructure. The entity type "other resources" refers to noteworthy resources that are not informational entities, technological entities, or human participants. Examples include office buildings, transportation equipment, and natural resources such as a sunny, comfortable climate, which might be very important for service systems in a resort hotel.



Note: Many elements in the conceptual model have goals, attributes, performance indicators, and related principles, patterns, and generalizations that do not fit into a one page representation, and that must be included in more detailed explanations.

Figure 1. Metamodel for an operational service system within a value constellation

Structure starts with the enterprise, organization, and value constellation. Value constellations contain a number of service systems. They constitute part of a service system's environment and affect the strategies of the enterprise, organization, and service system itself. Organizations consist of service systems that may or may not include a well-defined process but that must contain at least one activity. Each activity is performed by one or more actor roles including non-customer participant, customer participant, and automated agent.

Concepts related to intentions that are visible in the metamodel include product/service, customer, and strategy. Strategies summarize intentions for using resources to produce products and services. Product/service and customer appear on the side for intention because the purpose of a work system is to produce products and services for its customers. Other concepts related to intentions such as goals, metrics, characteristics, and incentives are relevant to service systems but are not shown in Figure 1. Instead, they are treated as attributes of specific elements or relationships. (Compare Fig. 2 in Thomas et al. (2008), which includes beliefs, values, and goals under the heading of spirit/purpose.)

Discussion

Within this paper's page limits it is impossible to explain all of the entity types, relationships between entity types, and the rationale for all of the representation choices. Since clarifications of terminology were covered in the section on definitions and premises, and since the metamodel specifies a set of relationships that are reasonably clear, this discussion section is organized around topics in a previously mentioned bullet list in the call for papers for the Service Science track. The metamodel and the underlying premises address some of the topics directly, such as design thinking for service systems service science concepts, and service system decomposition in valuable. Possible impacts on other topics such as service networks, techniques and tools for service composition, and business process synthesis are less direct.

Links to design thinking for service systems. A central goal of the metamodel is to support design thinking for service systems by spanning three levels that are part of a complete analysis and design of a service system's rationale and operation.

- **level 1: environment, strategy, and value constellation**. Design thinking for service systems needs to consider the environment and strategy on local three levels, enterprise, organization (e.g., department), and service system, plus relevant value constellations and the environment within which those value constellations exist. Design thinking should use information and insights about the environment and about internal competences and capabilities to consider or reconsider the strategy of the enterprise, the organization and the service system itself, and should ensure that strategies on the three levels are aligned. At all three levels, those strategies include value propositions for customers (of the enterprise, organization, and service system, respectively) and internal strategies for using resources to produce products/services (including coproduction wherever that occurs). For externally facing service systems, consideration of value constellations becomes a key question related to this service system's role in each relevant value constellation and how it might be possible to play that role more efficiently or effectively, possibly expanding or contracting that role based on priorities and capabilities. Available human, informational, and technical infrastructure also should be considered.
- **level 2: big picture view of the service system**. At a local level, a big picture view of the operation of the service system summarizes customer groups, primary products/services produced for those customer groups, processes and activities, participants, and information and technology that is used. This is the level of analysis that was pursued with some success by projects of advanced MBA students discussed in Truex et al. 2010, which reported on observations related to 75 management briefings written by advanced MBA students using a systems analysis template at this level of analysis.
- **level 3: service activities and other operational specifics**. A more detailed view is required to clarify specifics that must be clarified in order to create and maintain an efficient and effective service system. This starts by identifying which actor roles perform each activity, which customer participants, non-customer participants, and/or automated agents play each role, which resources are used for each activity, what each activity produces, and how whatever it produces is used either in subsequent

activities or by the service systems customers outside of the service system. Analysis on this level of detail leads to decomposing a service system into subsystems, some of which may be totally automated.

One of the advantages of an integrated metamodel that encompasses all three layers is that it encourages consideration of big picture and detail-oriented issues. Both must be dealt with in service system design.

Service science concepts. The metamodel and the underlying definitions express a number of service science concepts in ways that represent progress for service science. The first half of this paper discussed how various concepts expressed in the metamodel diverge from some of the more established views in service science. The metamodel treats service systems as operational systems rather than as systems of economic exchange. Using that perspective leads to the three layers of analysis and design mentioned above. A possible challenge for proponents of the economic exchange view of service systems would involve creating a different metamodel based on economic exchange, and showing how that could be used for service system design. One of the advantages of the metamodel in Figure 1 is that the terms and relationships are relatively familiar and can be instantiated at least to a first approximation without great difficulty in most service situations. This type of practicality was demonstrated by Truex et al. 2010, as mentioned above. The next stage in applying the metamodel would involve working through many details to make sure that the different layers are thoughtful and internally consistent.

Consistent with service-dominant logic, the term product/service reflects the fact that the metamodel makes no distinction between products and services as entity types, but recognizes that specific product/services have different characteristics that may appear in specific situations as more service-like or more product-like (e.g., degree of customization and extensiveness of customer interaction). While the metamodel does not explicitly represent subjective assessments such as value or customer value, attributes of each entity type include performance indicators that can be assessed in specific situations in which they are applicable. One of the main advances in the metamodel is that it treats human participants and automated agents in a somewhat symmetrical manner. This is important for decomposition of service systems, as will be discussed below.

The metamodel shows that a product/service produced by an activity may be used by customer participants and/or non-customer participants in subsequent activities, or may go to a customer outside of the service system. It recognizes that two out of three types of actor roles are played by human participants whose personal characteristics include capabilities and competences that could determine whether a service system operates according to intentions. It recognizes that each activity uses human, informational, technological, and/or other types of resources, and also that each activity produces informational, technological and/or other types of resources that may be used in other activities or that are received by customers outside of the service system.

Defining service as acts performed for the benefit of others helps in seeing that coproduction in sense of triggering action by requesting something (e.g., the definition of service by Sampson and Froehle 2006) hinges on a minimalist version of coproduction. Assume that each activity in a service system is performed by one or more actor roles for customer participants or non-customer participants. If a customer participant's request is the first of 20 activities and the next 19 are performed by non-customer participants, then we might say the service is coproduced even though only 5% of the steps involve coproduction. From a service system design perspective, the much more interesting point about coproduction is the design decision about how extensive coproduction should be within a particular service system and how much responsibility customer participants should bear for which activities.

The concept of value cocreation goes beyond coproduction because it concerns how and where customers capture value. When a service (as defined here) generates tangible things that are transferred to a customer, value capture occurs when the customer uses those things, often in other service systems that have other participants and other goals. The metamodel assumes that that type of situation is outside of the boundaries of the service system that is being analyzed. The alternative would involve stretching the service system's boundary to include subsequent value capture by a range of different customers in different types of service systems that they are involved with. Thus, the metamodel represents coproduction of value in a useful way but does not deal with value capture that extends outside of the boundaries of the original service system. As noted in Alter (2008b, 2010d) aspects of the value capture may extend across an entire service system even when tangible products are produced, such as through easier ways of negotiating service commitments, preparing for service instances, specifying what is desired, and performing other activities related to the service. Since product users are important sources

of product and innovations (von Hippel 1988), rich information about usage should be gathered outside of the service system that produces them.

Relation to specific topics often associated with service or service management. Since the metamodel tries to cover any real world service system, it is useful to see whether it covers many of the ideas that are often associated with one or another aspect of service or service management. We will look at a number of topics that appeared as questions in previous discussions and critiques from different viewpoints. Many other topics might have been chosen. In each case, assume that someone discussing the metamodel said, "yes, and what about X?" where X is one of the following topics:

- **Time**. The concept of time does not appear in Figure 1. The metamodel assumes that time can be treated implicitly through its appearance in attributes of activities (such as triggers, business rules, and metrics) and in attributes of product/services (such as availability dates and expiration dates).
- **Service level agreements**. The metamodel does not require SLAs since many service systems do not have SLAs. Where an SLA is relevant for a particular service system, the SLA would be treated as an attribute of the service system. The process of deciding on the SLA would be a management process that is separate from the service system in operation, just as the process of producing application software is different from the operation of the service system that uses the software.
- **Service quality**. The metamodel does not contain an explicit concept of service quality. In any specific situation, attributes of specific product/services and specific activities would include the relevant metrics, some of which would be metrics for service quality.
- **Service encounters**. The metamodel does not represent service encounter as a predefined concept. Service encounters occur in activities in which both customer participants and non-customer participants play a role. Activities in which customer participants make direct use of tools provided by the service provider (as in self-service use of an e-commerce website) might be considered service encounters because the tool represents the intention and competence of the service provider. The metamodel does not reflect other service encounters that are not explicit activities in a service system, such as when a bank's loan officer acts friendly to a customer's child while the customer is in the bank.
- **Service blueprinting**. The metamodel says nothing specific about service blueprinting, but potentially covers many of the basic concepts, such as the five components of a service blueprint (Bitner et al. 2008) mentioned previously: customer actions, onstage contact employee actions, backstage contact employee actions, support processes, and physical evidence. The metamodel would treat customer actions as activities performed by customer participants. It would treat onstage and backstage contact employee actions as activities performed by non-customer participants. In typical situations it would probably treat support processes as processes and activities within other service systems. Each component of the physical evidence at each step would be an attribute of the related activity. Concepts such as the line of interaction, line of visibility, and line of internal interaction could be inferred in some situations but not in others. For example, specific activities that have both customer participants and non-customer participants would typically be above the line of the interaction in a service blueprint.
- **Best practices**. The metamodel uses processes and activities to describe whatever practices occur service system. It expresses no particular view about whether those practices are "best practices" for any particular situation or for any larger class of similar situations. In general, the thinking underlying the metamodel views "best practices" as a marketing claim by vendors and consultants who often cannot know situation-specific issues, requirements, and constraints that may be unique to a particular service system in a particular setting. (e.g., see Wagner et al. 2006)
- **IT service management**. The metamodel says nothing in general about disparate groups of service systems that often appear under umbrella headings such as IT service management. If the metamodel were to be applied to any of the many processes that are generally included in IT service management, e.g., incident management, access management, release and deployment management and so on (itSMF, 2007)), it would provide a way to think about each of those processes as a service system, thereby demonstrating that the successful operation of the process involves not only the idealized definition of the process, but also situational factors such as the knowledge, skills, and interest of the participants.

- **Project management**. A project's work breakdown structure can be modeled using the concepts in the metamodel. For instance, specific roles perform specific activities whose attributes can include preconditions such as completion of a previous step, estimated duration, and postconditions. Separate from using the metamodel to model a project as a service system designed to produce certain product/services and then go out of existence, it is possible to model the management of the project as a separate service system whose goal is to keep the project on track and use resources efficiently.
- **Enterprise architecture**. The metamodel does not contain the concept of enterprise architecture because it is often far removed from the operational service systems that the metamodel focuses on. For example, assume that an IBM office in a city in South America wanted to use the metamodel to develop a new service system related to dispatching service technicians in the local area. Service designers would have to consider the relevant environment and the available infrastructure, but it is doubtful that they would have to consider a complete enterprise architecture.
- **USDL**. "The Unified Service Description Language 3.0 is a platform-neutral language for describing services. It has been consolidated from SAP Research projects concerning service related research and is intended as an enabler for wide leverage of services on the Internet." USDL contains modules named foundation, service level, participants, pricing, legal, service, interaction, functional, and technical. (Barros et al. 2011). While there are some high level overlaps between the metamodel and USDL, their purposes are different. USDL seems to be concerned with computerized services over the Internet. In contrast, the metamodel was designed to describe sociotechnical services, which could be decomposed to isolate totally automated services that might be described using USDL. It remains to be seen whether and how the two approaches might converge in a useful way.

Decomposition within service systems. The metamodel is designed to support tools that trace the decomposition of service systems as part of analysis and design processes. For any particular service system, that decomposition can be done in many different ways depending upon the goals and interests of the person doing the decomposition. For example, an IT professional might want to decompose the service system to isolate completely automated activities that might involve reuse of existing automated IT services or creation of new IT services. Someone interested in decision making might decompose a service system to isolate key decisions that have an important impact on the service system's performance. In either case, the decomposition would have to identify which activities belong in which subsystem. The resources produced and used by each activity within the original service system could be the basis of an initial test of whether the decomposition lost anything, since the production and/or use of each resource would still occur somewhere in the subsystems or would be replaced by the production and/or use of resources that are subdivided differently. The structure of the metamodel and the accommodation for isolating automated agents supports that type of decomposition.

Service systems and service networks. The metamodel for service system design is clearly a service system model rather than a service network model because it places a service system at the center and views the service system merely as part of a value constellation; the service system may (or may not) have interactions with other service systems in the value constellation and may have interactions with other service systems that are not part of the value constellation. The closest the metamodel comes to being a network model is its recognition that a service systems may be a component of one or more value constellations. Detailed modeling of service systems and service system interactions within a value constellation could generate an instantiation that is more like a network model. For example, a model that emphasized interactions between the various service systems in a value constellation could be viewed as the core of a service network. Details of each of the service systems could be displayed on the periphery, creating a network-like inner circle of service system interactions and a separate outer layer of local details for each service system.

Integration of IT service architecture with traditional services. The metamodel potentially leads toward integrating IT service architecture with traditional services through its symmetrical treatment of automated and non-automated activities. Activities are performed by actor roles that may be performed by human participants (customer participants or non-customer participants) or by automated agents. The actor roles use informational, technological, human, and/or other resources to perform service activities. Each service activity produces product/services that can be used in other activities within the service system or that can go to customers outside of the service system. Subsystems of service systems, including totally automated service systems, are service systems in their own right.

The integration of IT service architecture and traditional services for people, such as transportation, medical, legal, educational, or hospitality services, starts at the strategy level on each side. Traditional services are provided by one or more service systems, each of which can be represented using the metamodel and each of which uses IT in a number of ways. Wherever service activities are performed by automated agents, those automated agents are service systems ("performing acts for the benefit of another entity") that can be modeled using the metamodel. Wherever service activities within a service system are performed by people using IT-based tools, decomposition of a service system or subsystem can isolate activities and sub-activities that use those IT-based tools. At the points of interaction between the users and the tools, the activities performed by the tools (e.g., retrieving data or performing calculations) can be modeled as autonomous service systems that are triggered into action by user inputs. Thus, the metamodel provides a clean way to isolate automated subsystems of a traditional service system.

Coming at it from the other direction, regardless of how IT service architecture is originally represented in abstract high-level discussions, IT service architecture eventually must be realized as a set of service systems. If IT service architecture represents operational IT organizations (perhaps following ITIL, as summarized in itSMF (2007)) then human participants will play roles in those service systems, which include IT help desk systems, access management systems, and incident management systems. Alternatively, if IT service architecture is only technical architecture, then it summarizes a structure for producing services that can be modeled as a set of automated service systems. In either case, IT architecture can be represented as set of service systems that can be decomposed into successively smaller service systems. At some point, some of those service systems will touch service systems that provide services for human customers. In other words, the logic of the metamodel provides a path for integrating IT service architecture with services for people through successive decomposition and then identifying where the automated service systems support the services for people. Extensive research with a number of test cases is required to understand how that theoretically possible decomposition and matching would actually occur in practice.

Techniques or tools for automated service composition or for business process synthesis. The rationale and content of the metamodel illustrate aspects of the challenge posed by automated service composition even though the goals in constructing the metamodel focus elsewhere. One of the goals of the original metamodel in Alter (2010a) was to inspire a set of simple tools in the form of tables based on links in the metamodel. Such tables devote one column to a specific entity type in the metamodel (e.g., activity, participant, or informational entity within a service system) and devote another column or several columns to directly related entity types. Typical tables might include participants in all activities at a particular level of decomposition, informational entities used by each activity, or a set of characteristics or metrics related to activities, informational entities, or participants. (Alter, 2008b). Use of those tables might lead to a new type of front end to rigorous modeling tools such as UML and BPMN that specify details more precisely, including detailed flow logic. It is possible to extend those tables to develop hierarchy-oriented tools that traverse different levels of decomposition. Those tools might incorporate guidelines for successive decomposition based in part on system decomposition guidelines in the computer science literature (for technical artifacts), in the organization literature (for departmentation and division of labor), and possibly in other literatures.

Automated service composition (e.g., Rao and Su 2004; Bernardi et al. 2005) and business process synthesis (e.g., Wang and Nazeem 2011) come from the opposite direction and face many difficult challenges in three areas noted by Overhage (2002): technical or syntactic heterogeneities (e.g., different platforms or formats), semantic heterogeneity (different implementations of domain-specific concepts), and pragmatic heterogeneity (different sequences and methods for business processes). All of those issues are related to entity types in the metamodel. Technical and syntactic issues are related to the internal coding details of automated agents. Semantic issues may appear in the specifications of activities and in informational entities that are used or created. Pragmatic issues appear in the specification of activities and in the surrounding environment, including process interoperability in relation to relevant value constellations. Thus, the metamodel may be useful in some ways in thinking about the challenges of automated service composition and business process synthesis at a more intuitive level before delving into the details of automation methods in those areas.

Conclusion

This paper presented a perspective on service systems through a metamodel whose underlying concepts and premises are unique in a number of ways. The underlying definition of service is consistent with a more complex definition of service from service-dominant logic, but different from many definitions that attempt to define service in terms of characteristics that apply to some services but do not describe many others that are performed routinely in private and corporate life. The metamodel was designed to integrate a set of concepts that are relevant to service system design and service system innovation. It also traverses three essential levels of service design. Except in initial explorations and discussions posed broadly in terms of mission statements and value propositions, in real world situations it would be difficult to design service systems and service system innovations without considering each entity type in the metamodel.

This paper's contributions to service science started with comments and clarifications concerning basic concepts such as service, service system, customer, product/service, coproduction and cocreation of value, actor roles, resources, symmetrical treatment of automated and non-automated service systems, and the relationship between service dominant logic and service systems. Many articles have discussed these topics individually. Few if any have tied them together using an integrated metamodel.

Shortcomings. Although we believe that this paper's ideas and the metamodel that integrates them represent progress for service science, we also recognize a number of shortcomings. The metamodel is a theoretical construction whose precision and usefulness have not been tested through application in real world situations beyond hypothetical examples and informal inspection of many small case studies. The metamodel spans three levels of discussion but does not go to the level of detailed workflow logic that is included in formal modeling tools. The discussion section showed that the metamodel addresses important points in the current state of service science in meaningful ways. However, topics such as business process synthesis and automated service composition seem far beyond its reach, and need to be addressed from other directions related to computer science and software engineering techniques.

The metamodel identifies topics that should be considered in service system design and innovation, but does not provide a process for design or innovation. The literature on product and service design presents a number of relevant processes. Beyond this paper's scope, it would be interesting to analyze a number of those processes to see which parts of the metamodel they consider and which parts they ignore.

Some readers may be disappointed by the use of a definition of service that bypasses distinguishing between products and services. Even though it is consistent with service-dominant logic, thinking of service as just about any economic activity is inconsistent with the common notion that there is a difference between products and services and that totally non-customized commodity products are fundamentally different from services that respond to requests of specific customers. The rationale that product versus service should be treated as a set of continuous design variables, such as more goods-like or less goods-like or more customized vs. less customized, makes sense but still may not satisfy readers who believe that a clear distinction between products and services is important for service system design.

This paper is an attempt to contribute to discussions of fundamental issues related to service, service systems, and service system design. Great progress has occurred on many fronts in recent years. There are many ideas, many viewpoints, many interesting examples, and many ambitions. This paper contributes by integrating ideas in a way that has not been presented in the past and that could be the basis of future theoretical developments and empirical research.

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